WE CLAIM:

1. A by-pass valve mechanism for a well treatment tool having at least one packer element for sealing within the well casing of a well, permitting by-pass of well fluid past the packer element of the well treatment tool during conveyance of the well treatment tool within the well casing, comprising:

a by-pass valve housing being connected with a well tool and defining an internal flow passage in communication with a tubing string and at least one by-pass port establishing communication of the internal flow passage with an annulus between said by-pass valve housing and the well casing;

a valve element being moveable within said by-pass valve housing between an open position permitting flow of well fluid through said at least one by-pass port and a closed position blocking the flow of well fluid through said at least one by-pass port;

at least one retainer securing said valve element at said open position permitting fluid by-pass during tool running and releasing said valve element for closing movement responsive to predetermined fluid pressure.

2. The by-pass valve mechanism of claim 1, wherein said predetermined fluid pressure is tubing pressure.

3. The by-pass valve mechanism of claim 1, wherein said predetermined fluid pressure is the hydrostatic pressure of fluid within the well casing.

4. The by-pass valve mechanism of claim 1, comprising:

said by-pass valve housing defining an annular valve seat; and

said valve element being a tubular sleeve valve element located at least partially within said annular valve receptacle and defining a valve member, said tubular sleeve valve element being linearly moveable from an open position with said valve member retracted from said annular valve seat and permitting fluid flow through said at least one by-pass port and a closed position with said tubular valve portion establishing sealed engagement with said annular valve seat and blocking fluid flow through said at least one by-pass port.

5. The by-pass valve mechanism of claim 4, comprising:

said by-pass valve housing defining an internal housing sealing surface having a defined internal diameter;

said annular valve seat having an internal seat surface having a diameter less than said defined internal diameter; and

said tubular valve portion having a middle seal of a diameter establishing sealing engagement only with said internal housing sealing surface and having a lower seal of a diameter establishing sealing engagement only with said internal seat surface.

6. The by-pass valve mechanism of claim 5, comprising:

said internal housing sealing surface and said internal seat surface each being of cylindrical configuration and being of differing diameters.

7. The by-pass valve mechanism of claim 1, comprising:

said by-pass valve housing defining a valve receptacle and an annular valve seat; and

said valve element being a tubular sleeve valve element located at least partially within said annular valve receptacle and defining a circular valve member, said tubular sleeve valve element being linearly moveable within said valve receptacle from an open position with said valve member retracted from said annular valve seat and permitting fluid flow through said at least one by-pass port and a closed position with said tubular valve portion located within said valve receptacle and establishing sealed engagement with said annular valve seat and blocking fluid flow through said at least one by-pass port.

8. The by-pass valve mechanism of claim 1, comprising:

said by-pass valve housing defining a piston sealing surface;

said valve element being a sleeve valve element having an annular piston seal disposed in sealing engagement with said piston sealing surface and defining a pressure responsive area; and

fluid pressure within said flow passage acting on said pressure responsive area and developing a resultant force urging said sleeve valve element toward said closed position thereof.

9. The by-pass valve mechanism of claim 1, comprising:

said valve element being a tubular sleeve valve element defining at least one hydraulic area; and

fluid pressure within said flow passage acting on said at least one hydraulic area and maintaining said tubular sleeve valve element at said closed position one valve closure has occurred.

10. The by-pass valve mechanism of claim 1, comprising:

said at least one retainer being at least one shear element retaining said valve element at said open position thereof and shearing responsive to predetermined force on said valve element and releasing said valve element for pressure responsive closing movement.

11. The by-pass valve mechanism of claim 1, comprising:

said by-pass valve housing having upper and lower housing subs being releasably connected and defining an annular chamber having a generally cylindrical piston sealing surface;

said valve element being a sleeve valve member having an annular piston seal disposed in sealing engagement with said piston sealing surface; and

an upper seal element and a middle seal element establishing sealing between said sleeve valve element and said upper and lower housing subs on opposing sides of said annular piston seal and being of substantially equal sealing diameter.

12. The by-pass valve mechanism of claim 11, comprising:

said annular piston seal engaging said generally cylindrical piston sealing surface defining a hydraulic area of said sleeve valve element; and

at least one pressure port being defined in said by-pass valve housing and communicating annulus pressure externally of said by-pass valve housing to said hydraulic area of said sleeve valve element and developing a pressure responsive force urging said sleeve valve element toward said closed position thereof.

13. The by-pass valve mechanism of claim 1, comprising:

said by-pass valve housing defining an internal sleeve valve recess;

said valve element being a tubular sleeve valve member moveable within said internal sleeve valve recess between said open and closed positions; and

a tubular erosion sleeve element being located within said by-pass valve housing and having a portion thereof extending within said sleeve valve member and defining a protective internal covering minimizing the development of turbulence within said by-pass valve housing by-pass valve housing and minimizing fluid flow erosion of said sleeve valve element and said sleeve valve recess.

14. The by-pass valve mechanism of claim 1, comprising:

said valve element being a tubular sleeve valve member moveable within said by-pass valve housing during closing movement thereof, said tubular sleeve valve member defining a locking recess; and

a lock member located within said by-pass valve housing and being moveable into said locking recess upon closure of said tubular sleeve valve member and securing said tubular sleeve valve member at said closed position.

15. A method for by-passing well fluid past a packer element of a well treatment tool having a treatment fluid passage during conveyance of the well treatment tool within the well casing, comprising:

connecting a by-pass valve mechanism to the well treatment tool, said by-pass valve mechanism having a by-pass valve body defining a flow passage being in communication with said treatment fluid passage and having at least one by-pass port for communicating said flow passage with an annulus between the well treatment tool and the well casing, said by-pass valve mechanism having a valve element being moveable within said by-pass valve housing between an open position permitting by-pass flow of well fluid through said at least one by-pass port and a closed position blocking by-pass flow of well fluid through said at least one by-pass port;

connecting said by-pass valve body with a string of conveyance and treatment fluid supply tubing;

retaining said valve element at said open position during running of said well treatment tool and by-pass valve mechanism and permitting by-pass of fluid between said treatment fluid passage and said annulus;

releasing said valve element from said open position responsive to fluid pressure; and

causing pressure responsive movement of said by-pass valve element from said open position to said closed position.

16. The method of claim 15, comprising:

upon closing of said valve element, retaining said valve element at said closed position.

17. The method of claim 15, comprising:

employing tubing pressure for said pressure responsive movement of said valve element to said closed position.

18. The method of claim 15, comprising:

employing hydrostatic pressure of fluid for said pressure responsive movement of said valve element to said closed position.

19. The method of claim 15, wherein at least one shear element retains said valve element at said open position and said valve element is sealed to said by-pass valve body and defines a piston area, said method comprising:

said releasing step being applying sufficient pressure responsive force to said piston area to shear said at least one shear element and release said valve element from said by-pass valve body; and

applying sufficient pressure responsive force to said piston area to move said valve element from said open position to said closed position.

20. The method of claim 19, wherein said valve element defines a lock recess and a lock member is retained within said by-pass valve body and enters said lock recess when said valve element reaches said closed position, said method comprising:

causing pressure responsive movement of said valve element toward said closed position and positioning said lock recess in registry with said lock member; and

moving a portion of said lock member into said lock recess and causing said lock member to retain said valve element at said closed position.

21. A by-pass valve mechanism for a well treatment tool having at least one packer element for sealing within the well casing of a well, permitting by-pass of well fluid past the packer element of the well treatment tool during conveyance of the well treatment tool within the well casing, comprising:

a by-pass valve housing being connected with a well tool and defining an internal flow passage in communication with a tubing string and having at least one by-pass port establishing communication of the internal flow passage with an annulus between said by-pass valve housing and the well casing, said by-pass valve housing defining an annular internal valve receptacle and an annular internal valve seat;

a tubular valve element being moveable within said annular internal valve receptacle between an open position permitting flow of well fluid through said at least one by-pass port and a closed position establishing sealing with said annular internal valve seat and blocking the flow of well fluid through said at least one by-pass port and permitting the flow of fluid through said internal flow passage;

at least one shear element being mounted to said by-pass valve housing and having retaining engagement with said tubular valve element and securing said valve element at said open position permitting fluid by-pass during tool running and being sheared and releasing said valve element for closing movement responsive to predetermined fluid pressure.

22. The by-pass valve mechanism of claim 21, wherein said predetermined fluid pressure is tubing pressure.

23. The by-pass valve mechanism of claim 21, wherein said predetermined fluid pressure is the hydrostatic pressure of fluid within the well casing.

24. The by-pass valve mechanism of claim 21, comprising:

said by-pass valve housing defining an internal housing sealing surface having a defined internal diameter;

said annular valve seat having an internal seat surface having a diameter less than said defined internal diameter; and

said tubular valve portion having a middle seal of a diameter establishing sealing engagement only with said internal housing sealing surface and having a lower seal of a diameter establishing sealing engagement only with said internal seat surface.

25. The by-pass valve mechanism of claim 21, comprising:

said internal housing sealing surface and said internal seat surface each being of cylindrical configuration and being of differing diameters; and

said lower seal being spaced from said internal housing sealing surface and establishing sealing engagement with said internal seat surface preventing damage to said lower seal during movement of said sliding sleeve valve element to said closed position.

26. The by-pass valve mechanism of claim 21, comprising:

said annular valve seat defining an internal seat receptacle; and

said tubular valve element defining a tubular valve member establishing sealed engagement within said internal seat receptacle at said closed position of said tubular valve element and blocking fluid flow through said at least one by-pass port and permitting fluid flow through said tubular valve member.

27. The by-pass valve mechanism of claim 21, comprising:

said by-pass valve housing defining an internal piston sealing surface;

said tubular sleeve valve element having an annular piston seal disposed in sealing engagement with said piston sealing surface and defining a pressure responsive area; and

fluid pressure within said flow passage acting on said pressure responsive area and developing a resultant force urging said tubular sleeve valve element toward said closed position thereof; and

fluid pressure within said flow passage acting on said pressure responsive area and maintaining said tubular sleeve valve element at said closed position once valve closure has occurred.

28. The by-pass valve mechanism of claim 21, comprising:

said by-pass valve housing having upper and lower housing subs being releasably connected and defining an annular chamber having a generally cylindrical piston sealing surface;

said tubular sleeve valve element having an annular piston seal disposed in sealing engagement with said piston sealing surface; and

an upper seal element and a middle seal element establishing sealing between said tubular sleeve valve element and said upper and lower housing subs on opposing sides of said annular piston seal and being of substantially equal sealing diameter.

29. The by-pass valve mechanism of claim 28, comprising:

said annular piston seal engaging said generally cylindrical piston sealing surface defining said pressure responsive area of said tubular sleeve valve element; and

at least one pressure port being defined in said by-pass valve housing and communicating annulus pressure externally of said by-pass valve housing to said pressure responsive area of said sleeve valve element and said annulus pressure and tubing pressure developing a pressure responsive force urging said tubular sleeve valve element toward said closed position thereof.

30. The by-pass valve mechanism of claim 21, comprising:

said by-pass valve housing and said tubular sleeve valve element defining a sealed variable volume atmospheric chamber therebetween; and

air present within said sealed atmospheric chamber being compressed by decreasing volume of said variable volume atmospheric chamber during closing movement of said tubular sleeve valve element and cushioning closing movement thereof.

31. The by-pass valve mechanism of claim 21, comprising:

a test pressure control mechanism being present within said by-pass valve housing and permitting application of predetermined maximum test pressure to the well without causing shearing of said at least one shear element.